Teton River Monitoring Project

A Water Quality Sampling Project for the Teton River Tributaries

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Developed for: Teton Soil Conservation District
Henry's Fork Watershed Council
Idaho Association of Soil Conservation Districts
Idaho State Department of Agriculture
Idaho Department of Environmental Quality, Idaho Falls Regional Office

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Introduction

The subbasin assessment for the Teton Subbasin Total Maximum Daily Load (TMDL) analysis is currently being reviewed by the Environmental Protection Agency (EPA). Several stream segments have been listed in the TMDL for different pollutants. These pollutants include, but are not limited to, sediment, nutrients, and flow alteration. The purpose of a monitoring project for the Teton River tributaries is to help identify where agricultural related pollutant sources are coming from and determine the effectiveness of Best Management Practices (BMPs) installed on agricultural lands. The hydrologic unit code (HUC) for the Teton Subbasin is 17040204.

The Teton River originates from several tributaries that flow from the Teton and Big Hole Mountain Ranges (IDEQ 2001). The Teton Subbasin is shown in Figure 1. The Teton River drains approximately 1,132 square miles of which 806 square miles are located in Idaho. Most of these tributaries start on U.S. Forest Service land then flow through private lands. The major tributaries to the Teton River are Trail, Badger, and Bitch creeks. The Teton River flows for approximately 23 miles before the confluence with Badger Creek. Bitch Creek enters the Teton River approximately two miles after the confluence of Badger Creek and the Teton River. The river then flows west forming the borders of adjoining Teton and Fremont counties for eight miles until entering Madison County. In this stretch of river, Canyon Creek enters the Teton River.

Moody Creek is the largest tributary to the Teton River in Madison County. The Idaho Association of Soil Conservation Districts (IASCD) has a monitoring project located on Moody Creek that started in April 2001. The Idaho Department of Environmental Quality (2001) explains the physical, biological, and cultural characteristics in addition to the water quality concerns in the Teton Subbasin in the *Teton Subbasin Assessment and Total Maximum Daily Load (TMDL)*.

The monitoring of the Teton Subbasin will be a group effort with many different agencies. The Teton Soil Conservation District, the Henry's Fork Watershed Council (Watershed Advisory Group), Idaho Falls Regional Department of Environmental Quality (IDEQ), Idaho State Department of Agriculture (ISDA), and Idaho Association of Soil Conservation Districts will coordinate monitoring. Along with these agencies, the Natural Resources Conservation Service (NRCS) will provide support in reducing pollutants in the Teton Subbasin. Funding for the monitoring project will be provided by the ISDA and IASCD.

Background

The Teton River and numerous tributaries are listed on the State of Idaho 1998 303(d) list IDEQ published in accordance with the requirements of the Clean Water Act Section 303(d). The tributaries in the upper Teton Subbasin are primarily listed for sediment and flow alteration. The Teton River and tributaries in the lower Teton Subbasin are listed for nutrients and/or sediment. Horseshoe Creek, located in the upper Teton Subbasin, is listed only for flow alteration and

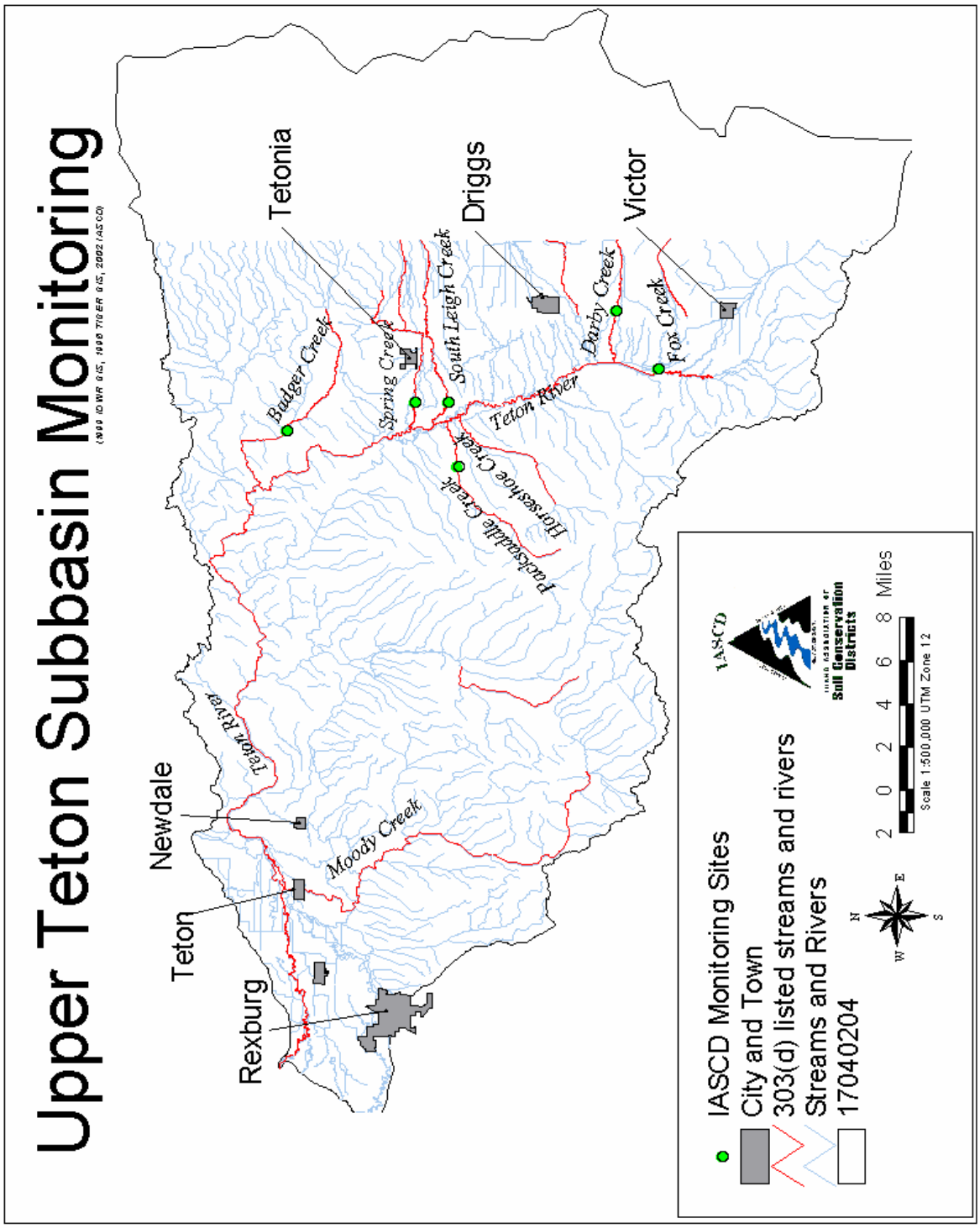

Figure 1. The Teton Subbasin Monitoring (Hydrologic Unit Code 17040204) with the Idaho Association of Soil Conservation District monitoring sites.

North Leigh Creek is listed for unknown pollutants. Summarized in Table 1 are the tributaries monitored and the pollutant of concern. Flow alteration and temperature will not be addressed in this monitoring project. The TMDL written on these parameters has been deferred to later years.

Table 1. Monitoring Sites, 303(d) Listings, and Pollutant Parameters for the Teton River Subbasin.

Monitoring Sites for the Teton River		
MONITORING STATION NUMBERS	**SUBWATERSHED NAME AND 303(d) LISTING STATUS**	**POLLUTANT PARAMETERS LISTED**
1	Badger Creek (303d listed)	Sediment
2	Spring Creek (303d listed)	Sediment, Temperature, Flow Alteration
3	South Leigh Creek (303d listed)	Sediment, Temperature
4	Packsaddle Creek (303d listed)	Sediment, Flow Alteration
5	Darby Creek (303d listed)	Sediment, Flow Alteration
6	Fox Creek (303d listed)	Sediment, Temperature, Flow Alteration

Pollutants can stress the human, aquatic, and terrestrial wildlife, when it impacts the beneficial use of a stream. The designated beneficial uses for the Teton River and its tributaries are cold water aquatic life, salmonid spawning, primary and secondary contact recreation, drinking water supply, and Special Resource Water (IDEQ 2001). The beneficial uses that are affected by the pollutants are cold water aquatic life and salmonid spawning. The primary land uses in the subbasin are agriculture and recreation (IDEQ 2001). The monitoring sites located on the tributaries of the Teton River are shown on Figure 1.

Program Objectives

IASCD will work in cooperation with the above mentioned agencies in attempt to complete the following objectives:

- Identify those streams that exceed water quality standards.
- Evaluate the impact of crop, pasture, and range lands, and recreation on the tributaries of the Teton River.
- Evaluate the water quality and discharge rates at various locations within these creeks and drains.

- Attempt to determine which areas contribute to the greatest level of loading with respect to TMDL parameters.

- Locate future areas where BMPs may be implemented to reduce sediment loads and riparian evaluations implemented on stream bank condition.

- Educate the public about the project.

Monitoring Program

This monitoring program will be implemented by IASCD with assistance from ISDA, Teton SCD, NRCS, and IDEQ. Other groups may assist in technical or fieldwork as needed. If more support is needed to assist in the gathering of monitoring data, university personnel may assist when available.

The monitoring sites located on the tributaries to the Teton River were selected with the assistance of the Teton Soil Conservation District. The sites were chosen to best reflect what the general impacts are to the tributaries and the mainstem of the Teton River. After one year from the start of the monitoring, IASCD, Teton SCD, NRCS, and IDEQ will review the monitoring data and make recommendations regarding whether the monitoring sites may be moved, or new sites selected, in the subwatershed to better delineate a problem area if one exists. The United States Geological Survey (USGS) states that fixed-interval sampling, which is what IASCD performs, should be conducted for at least two years (Gilliom et al 1995). If there are unusual hydrologic conditions during the first two years, such as extreme low or high flows or sparse existing data, the USGS recommends a third year of sampling may be added.

Samples will be collected on a bi-weekly schedule beginning in March 2002. Bi-weekly monitoring will continue throughout the summer and into the fall. The monitoring schedule will then switch to monthly for the winter months and early spring. When possible, additional monitoring may take place during certain storm events to assess their impacts on sediment loading. Some sites may be difficult to reach or completely frozen in the winter limiting winter sample collection.

Badger Creek headwaters are located in the Targhee National Forest on the east side of the Teton Valley. Approximately 40 percent of the Badger Creek subwatershed is located in Wyoming (IDEQ 2001). The remaining subwatershed, located in Idaho, is approximately 80 percent private land. The Badger Creek monitoring site is located below the confluence with Bull Elk Creek on private land. The site is above where Badger Creek flows into a canyon. The confluence with the Teton River is approximately four to five miles below the IASCD monitoring site.

The headwaters of North Leigh Creek are located in Wyoming while Spring Creek originates from a spring-fed pond in Idaho (IDEQ 2001). The Spring Creek subwatershed includes North Leigh Creek. The monitoring site for these tributaries will be below their confluence. Spring

Creek will be monitored approximately one and a half miles above the confluence with the Teton River.

South Leigh Creek originates from lakes located in Wyoming. It then flows through the Targhee National Forest into Idaho then through private land before entering the Teton River. The South Leigh Creek monitoring site will be located approximately one and a half miles above the confluence with the Teton River.

Packsaddle Creek is located on the west side of the Teton Valley. The headwaters are located in the Targhee National Forest. Packsaddle Creek flows for approximately three miles from the forest boundary to the confluence with the Teton River. The Packsaddle Creek monitoring site will be located approximately one to two miles above the confluence.

Darby Creek is located on the east side of the Valley. Most of Darby Creek is located in Wyoming. Once entering Idaho, it flows for approximately six miles to the confluence with the Teton River. Darby Creek flows through Idaho in several channels depending on the amount of water. It does not form one channel until near the confluence with the Teton River. The Darby Creek monitoring site will be located downstream from the county road just west of Highway 33. Darby Creek is in three different channels at this location and a flow weighted composite sample will be taken. The volume of water collected is based on the discharge rate of each individual stream channel. The final composite sample will be representative of the overall water quality of this stream at this site.

Fox Creek originates from the east side of the Teton Valley. The headwaters start in Wyoming then flow into Idaho. It splits into several intermittent channels in Idaho (IDEQ 2001). Towards the confluence with the Teton River, several springs add water to Fox Creek. The Fox Creek monitoring site will be located on the Idaho Department of Fish and Game (IDF&G) Teton River/Fox Creek access. This site is located on Fox Creek directly above the confluence with the Teton River. This site is inaccessible during winter months.

Sampling Methods

WATER QUALITY

Samples for water quality analyses will be collected by grab sampling directly from the source. The actual sampling sites, within the creeks and drains, will be located far enough upstream to avoid any backwater effects caused by other tributaries entering the stream. For very incised shallow creeks, six one-liter grab samples will be collected from a well-mixed section, near mid-stream at approximately mid-depth. For larger creeks, multiple grab samples will be collected at equal intervals across the stream's cross section to provide a representative sample. For shallow water sites (1 foot deep or less) grab samples will be collected by hand using a clean one-liter stainless steel container. At sites where the water depth is greater than one foot, a DH-81 integrated sampler will be used for water collection. Whichever method is used, individual samples will be collected at equal intervals across the entire width of the drain or creek. Each discrete sample will in turn be composited as mentioned in the following paragraph. The actual

location, number of grabs, and sample collection technique will be determined after observing the conditions at each sampling location.

Each grab sample will be composited into a 2.5-gallon polyethylene churn sample splitter. The resultant composite sample will then be thoroughly homogenized and poured off into properly prepared sample containers. For samples requiring filtration (ortho-phosphorous), a portion of the sample water will be transferred into the filtration unit and pressure filtered though a 0.45µm GN-6 Gelman Metricel Filter. The resultant filtrate will be transferred directly into a properly prepared sample bottle. The filtration unit will be thoroughly rinsed with deionized water and equipped with a new 0.45 µm filter at each sampling location. Water for nutrients, that require preservation, will be transferred into preserved (H_2SO_4 pH <2) 500 ml sample containers. The polyethylene churn splitter will be thoroughly rinsed with source water at each location prior to sample collection. Refer to Table 2 for a list of parameters, analytical methods, preservation, and holding times.

Table 2. IASCD Sampling Water Quality Parameters.

Parameters	Sample Size	Preservation	Holding Time	Method
Non Filterable Residue (TSS)	200 ml	Cool 4°C	7 Days	EPA 160.2
Volatile Residue (TVS)	200 ml	Cool 4°C	7 Days	EPA 160.4
Nitrogen-nitrate/nitrite	50 ml	Cool 4 °C H_2SO_4 pH<2	28 Days	EPA 300
Ammonia	150 ml	Cool 4 °C H_2SO_4 pH<2	28 Days	EPA 350.3
Total Phosphorus	100 ml	Cool 4 °C, H2SO4 pH < 2	28 Days	EPA 365.4
Ortho Phosphorus	100 ml	Filtered, Cool 4°C	24 Hours	EPA 365.2

All sample containers will be equipped with sample labels that will be filled out using water proof markers with the following information: station location, sample identification, date of collection, and time of collection. All resultant samples will be placed within a cooler, on ice, to await shipment to the laboratory. Chain-of-Custody forms will accompany each sample shipment. Samples will be delivered to Intermountain Analytical Services-EnviroChem (IAS-EnviroChem) in Pocatello, Idaho.

FIELD MEASUREMENTS

At each location, field parameters for dissolved oxygen, specific conductance, pH, temperature, and total dissolved solids will be measured. These measurements will be taken, when possible, from a well-mixed section, near mid-stream at approximately mid-depth. Calibration of all field equipment will be in accordance with the manufacture specifications. Refer to Table 3 for a listing of field measurements, equipment and calibration techniques. Photo points and GPS points will be taken at each monitoring site.

Table 3. IASCD Sampling Field Measurements.

Parameters	Instrument	Calibration
Dissolved Oxygen	YSI Model 55	Ambient air calibration
Temperature	YSI Model 55	Centigrade thermometer
Conductance & TDS	Orion Model 115	Conductance standards
pH	Orion Model 210A	Standard buffer (7,10) bracketing for linearity

All field measurements will be recorded in a bound logbook along with any pertinent observations about the site, including weather conditions, flow rates, personnel on site, or any problems observed that might effect the quality of data.

FLOW MEASUREMENTS

Discharge rates will be measured on drains and creeks that do not have an established rating station or staff gauge. Flow rates will be measured in an area upstream from the drain's discharge (into the river) to insure the measurements are not biased by potential backwater effects caused by the river.

Flow measurements will be made with a Marsh McBirney Flow Mate Model 2000 flow meter. The six-tenth-depth method (0.6 of the total depth below water surface) will be used when the depth of water is less than or equal to three feet. For depths greater than three feet the two-point method (0.2 and 0.8 of the total depth below the water surface) will be employed. At each gauging station, a transect line will be established across the width of the drain/creek at a perpendicular angle to the flow. The mid-section method for computing cross-sectional area along with the velocity-area method will be used for discharge determination. The discharge is computed by summation of the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. This method will be used to calculate cubic feet per second at each of the monitoring stations.

Quality Assurance and Quality Control (QA/QC)

IAS-EnviroChem utilizes EPA approved and validated methods. A method validation process including precision and accuracy performance evaluations and method detection limit studies are required of all of IAS-EnviroChem standard operating procedures. Method performance evaluations include quality control samples, analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are all part of IAS-EnviroChem's quality assurance program. Laboratory QA/QC results generated from this project can be provided upon request.

QA/QC procedures from the field-sampling portion of this project will consist of duplicates (at 10% of the sample load) along with blank samples (one set per sampling event). The field

blanks consist of laboratory grade deionized water, transported to the field, and poured off into prepared sample container. The dissolved phosphorous blank will be collected by filtering deionized water through the filtration unit and transferring the resultant filtrate into an appropriate sample container. The blank sample is used to determine the integrity of the field teams handling of samples, the condition of the sample containers supplied by the laboratory and the accuracy of the laboratory methods. Duplicates consist of two sets of sample containers filled with the same composite water from the same sampling site. The duplicates are used to determine both field and laboratory precision. The duplicate samples will not be identified as such and will enter the laboratories blindly for analyses. Both the duplicates and blank samples are stored and handled with the normal sample load for shipment to the laboratory.

DATA HANDLING

IASCD and ISDA staff will review all of the field data and analytical data generated from each sampling event. Each batch of data from a survey will be reviewed to insure that all necessary observations, measurements, and analytical results have been properly recorded. The analytical results will be reviewed for completeness and quality control results. Any suspected errors will be investigated and resolved if possible. The data will then be stored electronically.

Data Use

The data collected will be assessed by IASCD and ISDA staff for quality and completeness review. The data will then be available for agencies and individuals upon request. IASCD, ISDA, and SWCDs will use the data to determine loads of sediment or nutrients. The monitoring will allow agencies to have background information to develop implementation projects for the TMDL and measure project effectiveness. IASCD staff will be providing updates to the Teton SCD, Henry's Fork Watershed Council, and others on a periodic basis. IASCD will be producing a report with the data and recommendations at the conclusion of this project. This data can be used for educational purposes to landowners and can be tied together with biological data from IDF&G or IDEQ to provide a larger database.

References

Gilliom, R.J., W.M. Alley, and M.E. Gurtz. 1995. Design of the National Water-Quality Assessment Program—Occurrence and Distribution of Water-Quality Conditions: United States Geological Survey Circular 1112, 33p.

IDEQ. Idaho Department of Environmental Quality, 2001. Teton Subbasin Assessment and Total Maximum Daily Load (TMDL), Draft for Public Comment. 281 pp. Idaho Falls, Idaho.